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DISCRETE ADDRESS BEACON SYSTEM/AIR TRAFFIC CONTROL (DABS/ATC) F--ETC(U)
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Report No. FAA-RD-80-14

LEVEL II

DISCRETE ADDRESS BEACON SYSTEM/AIR TRAFFIC CONTROL FACILITY SURVEILLANCE AND COMMUNICATIONS MESSAGE FORMATS

ADA085108

APRIL 1980
FINAL REPORT

Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D.C. 20590

NOTICE

ERRATA SHEET

Report No. FAA-RD-80-14

Discrete Address Beacon System/Air Traffic Control
Facility Surveillance
and Communications Message Formats

Please make the following changes:

1. Page 3, paragraph 2.1.4, second line -
change "messges" to "messages"

2. Page 5, Item 3. -
change "Messges" to "Messages"

3. Page 17, paragraph 4.1.16, second line -
change "aircracft" to "aircraft"

4. page 18, paragraph 4.2.3, sixth line -
change "serach" to "search"

5. Page 19, paragraph 4.2.8, second line -
change "ATCBRS" to "ATCRBS"

6. Page 20, paragraph 4.4, eighth line -
eliminate "and" after the word "Surveillance"

7. Page 30, Fig. 5-1., ATCRBS Aircraft Control State Message
change the last bit from "24* (ICA+IUA)" to
"16+24* (ICA+IUA)".

8. Page 31, Fig. 5-2., First Format -
change "Message Rejection Notice" to "Message
Rejection/Delay Notice"

9. Page 31, Fig. 5-2., second format -
change "Message Delivery Notice" to "Uplink
Delivery Notice"

10. Page 36, paragraph 5.3.3.1.24, second line -
change "Mesage" to "Message"

11. Page 37, paragraph 5.3.3.2.2, first line -
change "bloc" to "block"

12. Page 40, paragraph 5.3.3.2.14, second line
change "communictions" to "communications"

13. Page A-1, fourth item -
change "Radr" to "Radar"

Technical Report Documentation Page

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16. Abstract

This document defines formats for messages which are to be transmitted between DABS and ATC facilities (en route or terminal). These messages include one-way surveillance reports to ATC and two-way communications messages. The latter support data link functions between ATC and DABS-equipped aircraft, as well as aiding in the monitoring and control of DABS sensors.

This document supercedes FAA-RD-74-63B dated April 1979.

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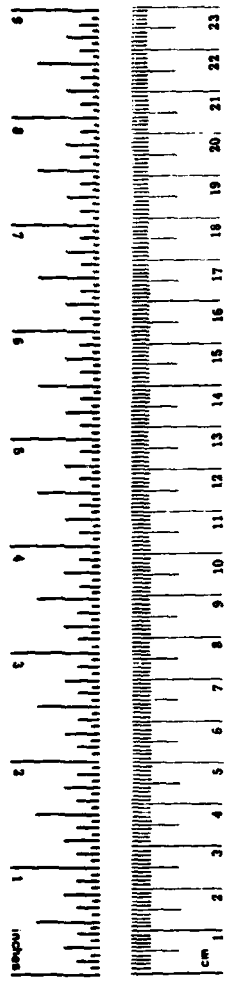
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

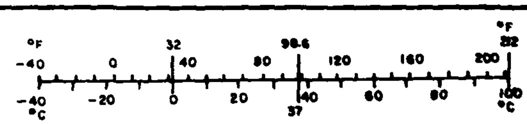
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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SECTION 1
INTRODUCTION

The Discrete Address Beacon System (DABS) is an evolutionary upgrading of the Air Traffic Control Radar Beacon System (ATCRBS). DABS provides improved surveillance and an integral ground-air-ground digital data link for transmission of Air Traffic Control (ATC) communication messages and other user messages.

It is the purpose of this report to define the kinds of information which flow in each direction across the interface between a DABS sensor and an ATC facility (En route or terminal). Further, for each type of message, a format is defined and the coding of each data block is specified.

The formats given here and the associated link procedures place requirements on the interface design. Actual design of interface equipment is beyond the scope of this report.

The DABS sensor has the capability to operate in a network of DABS sensors or as a stand-alone (i.e., with no sensor-to-sensor links). In reporting data to and receiving inputs from ATC, each DABS sensor operates independently of its neighbors. Interconnection of the DABS sensors will form a network.

The "network management" is carried on within the sensors, and the required exchanges of data flow between sensors, rather than between a sensor and an ATC facility. Briefly, the network management function within a sensor performs all tasks needed to:

(1) Maintain knowledge of the status of neighboring sensors
(2) Keep track of which sensors have surveillance responsibility for each DABS target
(3) Perform target handovers between neighboring sensors
(4) Interchange surveillance data between sensors in cases of prolonged target fades, and
(5) Handle all incoming and outgoing messages needed to manage the functions listed

The message formats described herein are those used between a DABS sensor and ATC facilities. Inter-sensor message formats and characteristics are not discussed although when DABS is operating in the "Relay Mode" some of the message formats described in this document are transmitted over the DABS network communications channel.

SECTION 2
SUMMARY OF MESSAGE TYPES

2.1 SURVEILLANCE REPORTS

Surveillance reports containing unsmoothed target measurements are sent on a one-way channel from a DABS sensor to an Air Traffic Control (ATC) facility (en route or terminal) on a once-per-scan-per-target basis. Several fixed-length formats are used.

2.1.1 DABS Report

A surveillance report based on replies from a DABS transponder uses the 91-bit DABS format. The principal data in this format are unsmoothed slant range and azimuth, reported altitude, time in storage, and the unique DABS address. Also included are several control bits indicating if: (a) an emergency ATCRBS code is present, (b) the return is radar reinforced, and (c) the DABS sensor is currently serving as the primary sensor for the target (with respect to delivery of synchronized interrogations, altitude echo data, ELM uplinks, and pilot-originated data link messages). Other indicators are also supplied.

The DABS format is also used to report radar data which correlate with a particular DABS target track in a scan during which no valid DABS replies are received.

2.1.2 ATCRBS Report

A surveillance report based on replies from an ATCRBS transponder uses the 91-bit ATCRBS format. The basic data include unsmoothed slant range and azimuth, time in storage, Mode 3/A Code and Mode-C altitude, if available. The surveillance data are reported with DABS-compatible precision. Other data and control fields currently used in the Common Digitizer (CD) formats are retained. In addition, the surveillance file number (with which the reported data have been correlated by a DABS sensor) and a correlation confidence indicator are included for tracked targets. The surveillance file number will uniquely identify an ATCRBS target and may be used by the ATC facility as an aid in its track correlation process. The ATCRBS format is also used to report radar data which correlate with a particular ATCRBS target track, in a scan during which insufficient ATCRBS data are received.

2.1.3 Radar Reports

A surveillance report which is based on returns which do not correlate with any beacon track (a "radar only" target) and when DABS is interfaced to the CD, uses the 52-bit radar format. This format is identical with the "search message" of the present CD format.

Surveillance reports for "radar only" targets, which are received from either the Moving Target Detector (MTD) or the Sensor Receiver and Processor (SRAP), use 91-bit formats. These formats are based on the present ATCRBS format but are distinguishable. The 91-bit message is used to allow for a surveillance file number and other information relating to the radar track.

2.1.4 Other CD Reports

The DABS sensor will pass on to ATC, without processing, all other received CD messges, using 52-bit formats. These include the Strobe, Map, Status, and Search RTQC Target reports.

2.2 COMMUNICATION MESSAGES

Communication formats are defined on two levels, "Frame Formats" (Section 5.1 and 5.2) and "Link Data Fields" (Section 5.3).

2.2.1 Frame Formats

Frame formats are the outer-level message structures needed to carry out transfer procedures on the link: the transmission of a message to a receiving station, the testing of that message by the receiving interface to determine its acceptability, the issuance of an acceptance or rejection response by the recipient, and further action (in case of a rejection or no response) by the transmitting station. The structures described here to provide for these procedures are a subset of those defined for the Common ICAO Data Interchange Network (CIDIN). Acceptance and rejection criteria are based on the frame format requirements which are tested by the interface of the receiving station, and not on an inner-level interpretation of message contents. Each frame carries several fixed-length fields of control data relating to interface functions. These include the address of the receiving or sending station, a control field, a frame check sequence (error detection code), and flags to denote the beginning and end of the frame. Formats and coding are defined for each of these fields in Section 5.1 and 5.2. Message data (as distinguished from control data), if present, are given in a variable-length Link Data Field. Interface procedures place no constraints, except length, on the coding of a Link Data Field.

2.2.2 Link Data Fields

When the interface of a receiving station has accepted a CIDIN message the control data fields are stripped off and the Link Data Field becomes the inner-level message. At this inner level, there are many types of messages, divided into several classes:

1. ATC-to-DABS Uplink Messages:
   Tactical Uplink Message (to a DABS aircraft)
   ELM Uplink Message (to a DABS aircraft)
   Request for Downlink Data (from a DABS aircraft)
   ATCRBS ID Request (to a DABS aircraft)
   Message Cancellation Request (of a previous uplink Message)

2. <u>ATC-to-DABS Status/Control Messages:</u>
   Test Message (to a DABS sensor)
   Altimeter Correction Message (to a DABS sensor)
   ATC Failure/Recovery Message (to a DABS sensor)
   Data Link Capability Request
   DABS Aircraft Control State Message
   ATCRBS Aircraft Control State Message
   Sensor/Failure Recovery Message
3. <u>ATC-to-DABS ATARS Operational Mesages:</u>
   (to be defined)
4. <u>DABS-to-ATC Sensor Response Message:</u>
   Message Rejection/Delay Notice (with respect to a DABS aircraft)
   Uplink Delivery Notice (with respect to a previous Uplink Message)
5. <u>DABS-to-ATC Downlink Messages, each from a DABS aircraft</u>
   Tactical Downlink Message
   ELM Downlink Message
   Data Link Capability Message
   ATCRBS ID Code Message
   Utility Message
6. <u>DABS/ATARS-to-ATC Operational Messages:</u>
   Controller Alert Message
7. <u>DABS-to-ATC Performance/Status Messages:</u>
   Test Response Message (from a DABS sensor)
   Status Message
   Track Alert Message (from a DABS sensor on a given target)
8. <u>DABS/ATARS-to-ATC Recording System Messages:</u>
   Duplicate ATARS Uplink Message (copy of an ATARS message to a DABS aircraft)
   Duplicate ATARS Message Delivery Notice (copy of a notice to ATARS with respect to a previous Uplink Message)

Each of these message types is identified by a type code, which serves to specify the format. Section 5.3 defines the format for each message type in terms of a fixed sequence of data blocks, and gives the definition and coding for each data block.

SECTION 3
SIGNAL CHARACTERISTICS

The data link between a DABS sensor and an ATC facility shall consist of two different channels: a one-way channel for surveillance data and a full duplex channel for communications. Each of these channels may in turn contain several parallel links as necessary to support the data rate at a particular site.

3.1 SURVEILLANCE SIGNALS

The surveillance channel carries surveillance data from the sensor to all users. The required data rate for the channel is dependent on the traffic environment and configuration of a particular DABS sensor, and, is therefore, not given here.

The signal formats used for surveillance resemble those currently used by the CD. Reports shall be transmitted in 13-bit sequences, 12 bits being data and the 13th an odd parity bit. Idle characters are required between messages and shall also be transmitted when no message is waiting.

Electrical signal characteristics and interface characteristics shall conform to the standards given in MIL-STD-188C, as defined in FCC Tariff 260. Message formats for the surveillance channel are given in Section 4.

3.2 COMMUNICATIONS SIGNALS

The communications data link shall be a two-way channel with a capacity of 4800 bits per second in each direction. The interface hardware shall provide all control data fields, timing, etc., necessary to exercise control over the channel.

Signal formats (and interface procedures) used for communications shall conform to the usage of the CIDIN, as specified by the International Civil Aviation Organization (ICAO) [1].

Electric signal charcteristics shall conform to MIL-STD-188C, as defined in FCC Tariff 260.

Message formats for the communications channel are given in Section 5.

SECTION 4
SURVEILLANCE MESSAGE FORMATS

Surveillance reports are issued by a DABS sensor to an ATC facility on a once-per-scan-per-target basis, using the data link described in Section 2.1 and the interface hardware described in reference [2]. The message formats used for beacon reports are modifications of the present CD formats, with the data transmitted in 13-bit sequences (12 data bits followed by an odd parity bit). Between reports, at least one idle character is transmitted, each consisting of the 13-bit sequence 000 111 111 111 1.

Beacon data are reported in either of two 91-bit formats, according to the different sources of target information: DABS or ATCRBS. These beacon formats are also used to report radar data which correlate with a beacon track, in the case where beacon data are missing on a particular scan. When radar data do correlate with a beacon track and beacon data are present, the beacon data are reported with a "radar reinforced" tag and the radar report is suppressed. The specification of the DABS and ATCRBS formats is given in Table 4-1.

Uncorrelated radar data from the common digitizer are reported in a 52-bit format, shown in Table 4-2 under the heading "Search" message. Also shown are four other messages which may be received from the CD, the Strobe, Map, Status, and RTQC reports. All of these messages are sent to the ATC in the same format in which they are received. The Strobe, Map, Status, and RTQC messages do not occur on a per scan basis but are sent whenever they are received, without processing by the DABS sensor.

Data from an MTD or SRAP (RDAS) radar digitizer which do not correlate with beacon reports or tracks are reported in 91-bit radar formats. These are described in Paragraph 4.4 for an MTD radar output and Paragraph 4.5 for an RDAS output.

4.1 DABS SURVEILLANCE FORMAT

The DABS format consists of 91 bits (seven 13-bit words). Each data field (except for spare and parity bits), as shown in Table 4-1, is briefly defined in the following paragraphs.

4.1.1 Test Indicator (Bit 1)

The Test Bit is set to "one" if the report correlated with a test track in the DABS surveillance file.

4.1.2 Format Identifier (Bits 2-4)

The code value 111 identifies the report as a 91-bit message in the DABS format.

4.1.3 P/S Indicator (Bit 5)

Bit 5 is used to indicate whether the reporting sensor is "primary" or "secondary" with respect to the target. Primary status indicates that the sensor is carrying out several functions which are omitted by secondary sensors: transmissions of synchronized interrogations, transmission of altitude echo data, extended length message uplink, and readout of pilot-originated air-to-ground data link messages:

1 = Primary
0 = Secondary

4.1.4 Mode C Indicator (Bit 6)

The Mode C bit (Bit 6) indicates the presence of an altitude field in bits 79-90 when set to "one". Every roll-call DABS report will contain an altitude; however, the presence of a "zero" in bit 6 indicates a report based on DABS all-call replies only, which do not include altitude. Relayed data always has the Mode C bit set to "one".

4.1.5 SPI Indictor (Bit 7)

Bit 7 indicates whether the pilot SPI (Ident) signal is currently set.

0 = No SPI
1 = SPI set

4.1.6 Radar Reinforced Indicator (Bit 8)

Bit 8 indicates whether the beacon track is currently reinforced by a radar return which correlates with the track.

0 = No radar correlation

1 = Radar reinforced

4.1.7 Code 7700/Code 7600 (Bits 9-10)

A "one" in either bit 9 or 10 flags the presence of the emergency ATCRBS codes 7700 or 7600, respectively.

4.1.8 FAA Indicator (Bit 11)

Bit 11 is reserved in all surveillance formats to indicate whether or not the data are of interest to ATC facilities. This bit will normally be set to "one."

4.1.9 Radar Indicator (Bit 12)

The radar field indicates whether the report contains beacon data or correlated radar data (but not both; for both, see Section 4.1.6). The radar data may derive from an MTD, an RDAS or a Common Digitizer:

0 = DABS beacon data

1 = Radar data (see 4.2.3)

4.1.10 Range (Bits 14-25, 27-29)

Range (slant range) is encoded as a 15-bit binary integer with MSB = 128 nautical miles. This field has been expanded with respect to the CD format to provide greater precision (0.0078 nautical miles increment).

Bit	DABS	ATCRBS
1	Test	Test
2	1	1
3	1	1
4	1	0
5	P/S	Mode 3/A
6	Mode C	Mode C
7	SPI (Ident)	SPI (Ident)
8	Radar Reinf.	Radar Reinf.
9	Code 7700	Code 7700
10	Code 7600	Code 7600
11	FAA	FAA
12	Radar	Radar
13	PARITY	PARITY
14	↑ MSB = 128	↑ MSB = 128
15		
16		
17		
18		
19		
20	Range	Range
21	(nmi.)	(nmi.)
22		
23	(cont.)	(cont.)
24		
25		
26	PARITY	PARITY

Table 4-1. Surveillance Message Formats - Beacon

Bit	DABS	ATCRBS
27		
28	Range (nmi.) (cont.)	Range (nmi.) (cont.)
29	LSB=0.0078	LSB=0.0078
30	MSB = 180	MSB = 180
31		
32		
33		
34	Azimuth	Azimuth
35	(deg.)	(deg.)
36		
37		
38		
39	PARITY	PARITY
40		
41		
42		
43	LSB=0.044	LSB=0.044
44	Alert	Confidence
45	S	Code in Transition
46	S	False Target
47	Relay Mode	Relay Mode
48	MSB = 1	MSB = 1
49	Time in Storage	Time in Storage
50	(sec.)	(sec.)
51	LSB=1/8	LSB=1/8
52	PARITY	PARITY

S = Spare

Note: Spare bits = 0

Table 4-1. Surveillance Message Formats - Beacon (Continued)

Bit	DABS	ATCRBS				
53	↑	↑	A4			
54			A2			
55			A1			
56	DABS	Mode 3/A	B4			
57	Address	Code	B2			
58			B1			
59			C4			
60			C2			
61			C1			
62			D4			
63			D2			
64	↓	↓	D1			
65	PARITY	PARITY				
66		↑				
67						
68						
69		Surveillance				
70		File				
71		Number				
72						
73				For CD	For MTD	For RDAS
74				Radar	Radar	Radar
75				Substi-	Substi-	Substi-
76				tution	tution	tution
77	↓	↓		(Bit 12 =	(Bit 12 =	(Bit 12 =
78	PARITY	PARITY		1)	1)	1)
79	Sign: ↑	Sign: ↑		↑MSB=16	MTD	RDAS
80	MSB=	MSB=		Runlength	Quality	Quality
81	102400	102400		(ACP)LSB=4	S	
82	Ft.	Ft.		S	S	↓
83	Mode C	Mode C		S	S	S
84	Altitude	Altitude		S	S	S
85	(feet)	(feet)		S	S	S
86				S	Ground Tgt	S
87				S	S	S
88				1	1	1
89				0	1	0
90	↓ LSB=100	↓ LSB=100		0	0	1
91	PARITY	PARITY		PARITY	PARITY	PARITY

S = Spare

Note: spare bits = 0

Sign: 0 = Positive

1 = Negative

Table 4-1. Surveillance Message Formats - Beacon (Continued)

Table 4-2. Surveillance Message Formats - CD.

Bit No.	Search	Strobe	Weather Message & CD MAP	Status	Search RTQC TGT
1	TEST	TEST	TEST	TEST	1
2	0	0	0	0	0
3	0	0	0	0	0
4	1	1	0	0	1
5	1	1	0	1	0
6	0	0	0	1	0
7	1	0	0	0	1
8	1	0	Map Variation	0	0
9	0	Strobe Variation		0	0
10	0			0	0
11	FAA	FAA	FAA	FAA	FAA
12	AF	AF	AF	AF	AF
13	PARITY	PARITY	PARITY	PARITY	PARITY
14	MSB=128	MSB=128	MSB = 128	Radar Alarm	0 MSB=128
15				Beacon Alarm	0
16				CD Alarm	0
17	Range	Range	Range Start	0	0 (Range)
18	(nmi)	(nmi)	(nmi)	0	0 (nmi)
19				AIMS Alarm	0
20				Standby Radar Alarm	0
21				Standby Beacon Alarm	1
22				Standby CD Available	0
23				0	0
24	LSB=0.125	LSB=0.125	LSB = 0.125	HPG Reg. Line Alarm	0 LSB=0.125
25	0	0	0	0	0
26	PARITY	PARITY	PARITY	PARITY	PARITY

Table 4-2. (Continued)

Bit No.	Search	Strobe	Weather Message & CD MAP	Status	Search RTQC TGT
27	MSB=2048	MSB=2048	MSB=2048	HPC Req. Parity Alarm	MSB=[illegible]
28				0	
29				DSG Alarm	
30	Azimuth	Azimuth	Azimuth	0	Azimuth
31	(ACP)	(ACP)	(ACP)	0	(ACP)
32				0	
33				0	
34				Sens. Det. On	
35				R.L. Discr. On	
36				Normal Sector 3	
37				Normal Sector 2	
38	LSB = 1	LSB = 1	LSB = 1	Normal Sector 1	LSB = 1
39	PARITY	PARITY	PARITY	PARITY	PARITY
40	AIMS Present	MSB=256		Outer Contour	MSB=[illegible]
41	MSB AIMS Code			Inner Contour	
42	LSB AIMS Code	Run Length		Fixed Map On	Run Length
43	MSB=16	(ACP)	Range Stop	High Speed Timing Alarm	(ACP)
44	Run Length (ACP)		(nmi)	1/2 Scan Inhibit Alarm	
45	LSB = 4			Buffer Overload Alarm	
46	MSB = 4	LSB = 4		0	LSB = 4
47		MSB = 2		0	MSB = [illegible]
48	Time in Storage			0	
49	(sec.)	Time in Storage		Sensitive Sector 3	Time in Storage
50		(sec.)	LSB=0.125	Sensitive Sector 2	(sec.)
51	LSB=1/8	LSB=1/8	0	Sensitive Sector 1	LSB=1/[illegible]
52	PARITY	PARITY	PARITY	PARITY	PARITY

Bit	RDAS & MTD SEARCH
1	Test
2	1
3	1
4	0
5	S
6	S
7	S
8	S
9	S
10	S
11	FAA
12	1
13	PARITY
14	MSB=128
15	
16	
17	
18	
19	
20	Range
21	(nmi)
22	
23	
24	
25	(Cont.)
26	PARITY
27	
28	
29	LSB=0.0078
30	MSB=180 deg
31	
32	
33	Azimuth (deg)
34	
35	
36	
37	
38	(Cont.)
39	PARITY

S = Spare   Note: spare bits = 0

Table 4-3. Surveillance Message Format RDAS & MTD Radar

Bit	RDAS & MTD SEARCH	
40		
41	Azimuth (cont.)	
42		
43	LSB=0.044	
44	AIMS Present	
45	S	
46	MSB=4	
47		
48	Time in Storage (sec)	
49		
50		
51	LSB=1/8	
52	PARITY	
53	MTD	RDAS
54		
55	Doppler #1	S
56		
57		
58		
59	MTD	RDAS
60		
61	Doppler #2	S
62		
63		
64		
65	PARITY	PARITY
66		
67		
68		
69	Surveillance	
70	File	
71	Number	
72		
73		
74		
75		
76		
77		
78	PARITY	

Bit	RDAS & MTD SEARCH	
79	MTD	RDAS
80	Quality	Quality
81	MTD	
82	Confidence	
83		S
84		S
85	False Tgt	False Tgt
86	Ground Tgt	S
87	S	S
88	0	0
89	1	0
90	0	1
91	PARITY	PARITY

S = spare

Note: spare bits = 0

Table 4-3. Surveillance Message Format RDAS & MTD Radar (Continued)

4.1.11 Azimuth (Bits 30-38, 40-43)

Azimuth is a 13 bit binary integer with MSB = 180 degrees and LSB = 0.044 degrees. The azimuth is measured relative to magnetic north.

4.1.12 Alert Indicator (Bit 44)

A "one" in bit 44 signifies that the pilot's "alert" signal has been set and read out. This signal indicates that the pilot has changed his Mode 3/A code, and is interpreted by the DABS sensor as a request to have Mode 3/A code read out.

4.1.13 Not Used

4.1.14 Relay Mode (Bit 47)

A "one" in bit 47 indicates that the message contains data relayed from a remote DABS sensor in place of local data. Position data are in local coordinates.

4.1.15 Time in Storage (Bits 48-51)

This 4-bit field (LSB = 1/8 second) contains the elapsed time between the receipt of the reply at the antenna and the output of the report to the interface output buffer. Time in storage for the radar substitution report equals the sum of the radar digitizer time in storage and the local DABS sensor time in storage.

4.1.16 DABS Address (Bits 53-64, 66-77)

DABS target address is a 24-bit field. Codes will be assigned to represent each aircracft uniquely.

4.1.17 Mode C Alitude (Bits 79-90)

Altitude is a 12-bit signed binary integer with LSB = 100 feet. The data are not pressure-corrected.

4.1.18 Run Lengths (Bits 79-81)

For radar substitution reports only, bits 79-90 are not interpreted as Mode C Altitude. Instead, bits 79-81 contain radar run length, as given in the CD search message received by the DABS sensor. (See the search message format in Table 4-2). If the radar substitution report derives from an MTD radar, run length is not present; instead bits 79-80 contain quality (see 4.4.2) and bit 81 is spare. If the radar substitution report derives from a SRAP (RDAS) radar, runlength is not present; instead bits 79-82 contain quality (see 4.5).

4.2 ATCRBS SURVEILLANCE FORMAT

As shown in Table 4-1, the ATCRBS report format is also 91 bits in length, as identified by a 11 code in bits 2 and 3. Bit 4 contains a 0 to distinguish the format from DABS. The control bits are similar to those described above for the DABS format, but with differences as noted in bits 5, 6, 12, 44, 45, and 46. Other indicators unique to ATCRBS are defined below. The data fields which encode range (bits 14-25, 27-29), azimuth (bits 30-38, 40-43), relay mode (bit 47), time in storage (bits 48-51), and Run Length (or quality) for the case of radar substitution (bits 79-81), are all identical with the corresponding fields of the DABS format.

4.2.1 Mode 3/A Bit (Bit 5)

Bit 5, the Mode 3/A bit, is set to "one" when the number of valid 3/A responses exceeds zero.

4.2.2 Mode C Bit (Bit 6)

Bit 6, the Mode C indicator, is set to "one" if all confidence bits are high (i.e., Valid Mode C data in bits 79-90) and the code bits are not all zeros.

4.2.3 Radar (Bit 12)

Bit 12 is a format control bit indicating whether the message contains radar data rather than beacon data. If bit 12 is not set, the message is a standard ATCRBS report. If bit 12 is set to one, the format is further defined by bits 88-90, as follows:

100: The message contains radar substitution data from common digitizer radar (i.e., serach data which correlate with an ATCRBS track for which beacon data are not available). In this case, bits 79-81 contain Run Length, as shown in Table 4-1.

110: The message contains radar substitution data from an MTD radar. In this case, Bits 79-80 contain Quality and Bit 81 is a spare.

101: This message contains Radar Substitution data from an RDAS radar. In this case, bits 79-82 contain quality.

010: The format is an MTD Search Message (see 4.4).

001: The format is an RDAS Search Message (see 4.5).

Other values are not assigned

4.2.4 Confidence Indicator (Bit 44)

Bit 44 indicates whether the ATCRBS data reported have been correlated with a track (see Section 4.2.8) with high or low confidence.

1 = High confidence

0 = Low confidence

4.2.5 Code in Transition Indicator (Bit 45)

A "one" in Bit 45 signifies that the ATCRBS code of the report does not match that of the track with which it has been correlated. This normally would indicate that the pilot has changed his code.

4.2.6 False Target Indicator (Bit 46)

A "one" in Bit 46 signifies that sensor surveillance processing has tagged the target report as false.

4.2.7 Mode 3/A Code (Bits 53-64)

The 12-bit field contains the ATCRBS code in standard CD format, whenever the Mode 3/A Indicator (Bit 5) equals "one." For a radar substitution report, the Mode 3/A Field will contain the mode 3/A code of the last beacon report correlating with the sensor track but the Mode 3/A bit (Bit 5) will not be set.

4.2.8 Surveillance File Number (Bits 66-77)

Bits 66-77 contain a Surveillance File number. This field provides the ATC facility with a unique ATCBRS track correlation as performed by a particular DABS sensor, whether or not the target is using a discrete Mode 3/A code. The coding is a binary 12-bit integer and is "locally unique" for a particular sensor, in the sense that the same number will not be assigned to more than one track at a time. The coding is not common among DABS sensors; i.e., two DABS sensors simultaneously tracking the same ATCRBS target will report it using

different file numbers. The value of all zeros is reserved to indicate an uncorrelated ATCRBS target report.

4.2.9 Mode C Field (Bits 79-90)

The Mode C field contains a valid decoded altitude when the Mode C bit (Bit 6) is set to "one." When the Mode C bit is set to "zero" the Mode C field contains the first 12 bits, A_4 through D1 of the transformed code pulse sequence.

4.3 CD SURVEILLANCE FORMATS

The format for uncorrelated radar reports, as shown in Table 4-2 as the Search message, is 52 bits in length. The 52-bit messages are distinguished from the 91-bit beacon reports by a "00" code in Bits 2-3. Four other 52-bit formats are also given in Table 4-2: the Strobe, Map, Status, and Search RTQC Target messages. The weather message from other radar digitizers is identical to the CD Map message. These types are distinguished from each other by their code patterns in Bits 4-10.

Each of these formats is identical with the corresponding CD format as received by the DABS sensor. Messages in these formats are not processed by DABS (except for the Search message) but are passed to ATC unaltered. The Search message is forwarded unaltered when the data do not correlate with a beacon target report or track. If the radar data correlate with a track, they are forwarded after reformatting into a beacon message (the Radar Substitution case). If the radar data correlate with a beacon report, they are not forwarded (the Radar Reinforcement case).

4.4 MTD RADAR SURVEILLANCE FORMAT

The format for MTD radar reports, shown in Table 4-3 as the MTD Search message, is 91 bits in length. It is distinguished from all other 91-bit messages by a zero in Bit 4, a one in Bit 12, and Bits 88-90 set to 010. The data fields which are unique to this message are defined below. The other fields include Range and Azimuth (with field lengths and locations matching those of the beacon formats), AIMS present, time in storage (matching that of the search message), and Surveillance and File Number (identical to that of the ATCRBS message). All DABS tracks, whether beacon, or MTD or RDAS radar, are contained in one file so that there is a single set of Surveillance File Numbers for a given sensor.

4.4.1 Doppler #1 and Doppler #2 (Bits 53-58 and 59-64)

These two 6-bit fields express the interpolated values of the doppler velocities measured at the low and the high PRF of the radar, respectively. Each field is a binary integer taking on values between zero and the blind speed corresponding to the PRF. Because the values of PRF are not yet determined and may be adapted to the radar site, the scaling of these fields is not presently defined.

4.4.2 Quality (Bits 79-80)

Quality is a 2-bit field expressing a figure of merit for the reported azimuth value. The coding is a binary integer "score" with 00 being the worst and 11 the best quality.

4.4.3 MTD Confidence (Bits 81-84)

MTD confidence is a 4-bit field expressing an estimate that the measurement represents a real aircraft rather than a false alarm. Each bit gives a confidence estimate (1-high, 0-low) in a different category; thus, a report which is most likely to be from an aircraft would have the value 1111. The four categories are not fully defined at present.

4.4.4 False Target Flag (Bit 85)

The false target flag is a 1-bit field expressing that a new radar report exists with a high probability of being false whenever this bit is set to 1.

4.4.5 Ground Traffic Indicator (Bit 86)

The ground traffic indicator is a 1-bit field expressing that the report lies within a geographical region which has been predefined by the MTD as containing heavy ground traffic. It is intended that the users of primary radar surveillance reports may use the ground traffic indicator bit for tracking or display filtering.

4.5 RDAS SURVEILLANCE FORMAT

RDAS uses the same surveillance message format as MTD with the differences defined in Table 4-3. The RDAS radar report, however, is distinguished from all other 91-bit messages by a zero in Bit 4, a one in Bit 12, and Bits 88-90 set to 001. In addition, the contents of the RDAS fields differ as follows:

(1) RDAS quality is derived from the radar run length and is the 4-bit quality field received from the RDAS and transmitted by DABS unmodified.

(2) Bits (83 & 84) and Bits (53-64) are spares and shall be set to zero.

4.6 WEATHER MAP MESSAGES

To maintain compatibility among several primary radar digitizers, DABS, and the users of weather data, a common weather message format and sequencing is required.

DABS receives digitized primary radar weather reports from either the CD, SRAP/RDAS, or the MTD and can disseminate the same weather reports to three possible users: the ARTS IIIA DPS, the Video Reconstitutor, and the En route ATC Automation. (Figure 4-1)

4.6.1 Weather Map Message Format

The weather map message format is defined in Table 4-2.

4.6.2 Weather Map Message Sequencing

The content and sequencing of the weather messages is determined by the radar digitizer. DABS will receive each weather message, subject each message to data formatting and dissemination rules, and merge it into a common narrow band radar, beacon, weather surveillance data stream to ATC.

It is necessary for the radar digitizer to control the comparison of high and low weather intensity in order to establish thresholds such that the contour data for selected thresholds are reported on the correct scans, and that the message contents accurately represent the intensity and location of the weather clutter. The weather data output shall be interlaced such that the messages for a given threshold are uniformly divided in azimuth between three antenna scans. The interlace will require six antenna scans to completely transmit or update the weather data.

For example, thresholds 1 (low intensity weather) and 2 (heavy intensity weather) shall be reported on a continuous three scan interlace as follows: 111 222. On scans 1, 2 and 3, low intensity weather map messages will be transmitted. On scans 4, 5, and 6, high intensity weather map messages will be transmitted.

Approximately one-third of the weather data of high or low intensity will be transmitted during each of the three scans (1, 2, and 3, or 4, 5, and 6) which are required to complete transmission of either the high or low intensity weather map data. Only weather data at the selected azimuth interval will be transmitted during each of these scans.

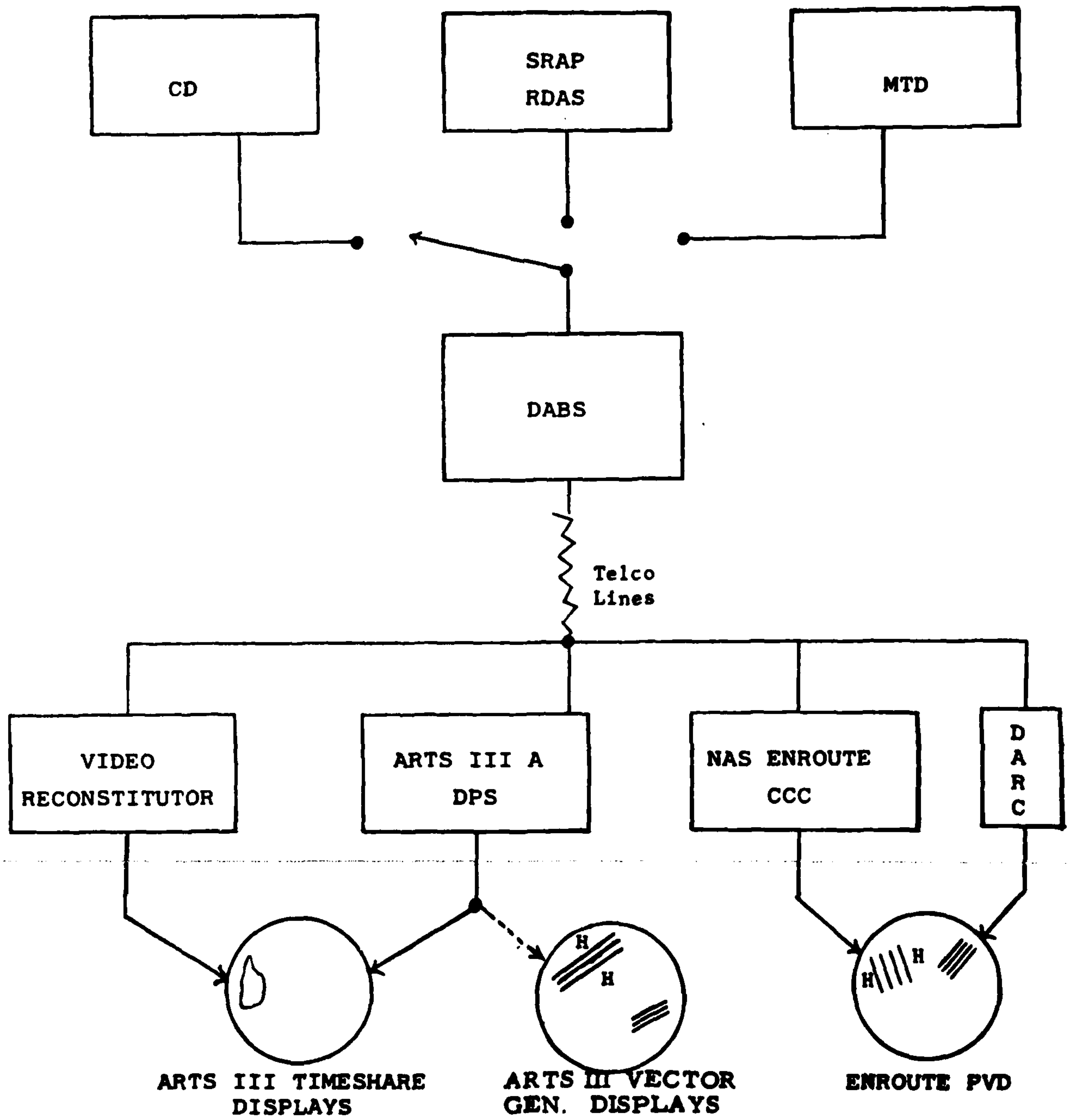
The method of transmission will be as follows:

a. Low intensity weather map
   1. On scan 1 transmit message at azimuth intervals (2, 5, 8, 11.......)
   2. On scan 2 transmit messages at azimuth intervals (1, 4,7, 10........)
   3. On scan 3 transmit messages at azimuth intervals (0, 3, 6, 9, 12....)

b. High intensity weather map

   1. On scan 4 transmit messages at azimuth intervals (2, 5, 8, 11.....)
   2. On scan 5 transmit messages at azimuth intervals (1, 4, 7, 10.....)
   3. On scan 6 transmit messages at azimuth intervals (0, 3, 6, 9, 12.....)

If weather does not exist in the last azimuth interval of the low or high weather series, a message will be sent for this interval with range start equal to range stop. This message serves to notify the user of the high and low intensity weather map boundaries.



WEATHER DATA DISSEMINATION

FIGURE 4-1

SECTION 5
COMMUNICATION MESSAGE FORMATS

Transmission of communication messages between the sensor and an ATC facility will be done in conformance with the formats and procedures of the CIDIN for a balanced point-to-point, two-way data interchange. Two-way communications betweeen the DABS sensor and the ATC en route facility is accomplished through a front end processor (FEP). The FEP uses the CIDIN protocol in its communications with the DABS and the "9020 protocol" and message formats [3] in transmitting and receiving communications from the 9020 CCC. Detailed procedures to be used in carrying on CIDIN message exchanges between stations are not given here, but are contained in Annex 10 to the Convention on International Civil Aviation [1].

5.1 FRAME FORMATS

5.1.1 General

The basic unit of transmission is a frame which is a bit sequence containing not fewer than 32 bits and not more than 2040 bits. Since all messges between DABS sensors and ATC facilities (and their interface-generated responses) fall within these limis, there is an exact correspondence between a frame and a message. The frame format consists, in general, of 6 "sequences" or data blocks, as shown below:

Data Link Control Field				Data Link Control Field	
FLAG	ADDRESS	CONTROL	LINK DATA FIELD (LDF)	FRAME CHECK SEQUENCE (FCS)	FLAG

The detailed coding for each of these fields is specified in reference 1.

5.2 FRAME DATA BLOCKS

5.2.1 Flag

The Flag character at the beginning and end of every frame is the standard 8-bit sequence:

0	1	1	1	1	1	1	0

The end flag of one frame can also serve as the beginning flag of the following frame. This Flag code also serves as an idle character on the link, i.e., it is transmitted continuously in the absence of message traffic, serving as an indicator that the link is functioning.

It should be pointed out that CIDIN provides for code and byte-independent transmissions, i.e., there are no reserved characters that could not be part of the message. To prevent the Flag sequence from occurring in a message, a zero is inserted after every five 1-bit sequences by the transmitting station and is removed by the receiving stations before "unpacking" the message. These operations are part of the task of the interface.

5.2.2 Address

The address is an 8-bit sequence. The coding of the address is as follows: Any frame transfer commands from the ATC facility to the DABS sensor shall use Address A (11000000). Any response from the DABS sensor to the ATC facility shall use Address B (10000000).

5.2.3 Control

This field shall be encoded as specified in reference 1.

5.2.4 Link Data Field

Link Data Field formats are defined in Section 5.3.

5.2.5 Frame Check Sequence

The Frame Check Sequence is defined in Reference 1.

5.3 LINK DATA FIELDS

5.3.1 General

The Link Data Field contains the actual message data which the sender wishes to communicate to the recipient. There are many different types of messages, as listed in Section 2.2.2. The interpretation of the Link Data Field format and coding is dependent on the particular message type. In the rest of Section 5.3, the formats of the various types of DABS-to-ATC and ATC-to-DABS messages are described in terms of data blocks, and the definitions and coding of the data blocks are given.

5.3.2 Link Data Field Type Codes

For each of the messages defined in Section 2.2.2, Table 5-1 gives a value of a Type Code, which always appears as the first data block in a Link Data Field. These codes are 8 bits in length, the first 4 of which are a prefix which refers to a logically similar group of message types. It should also be noted that the code assignment scheme encompasses numerous other types of messages (which go between 2 or more DABS sensors); hence, the codes shown in Table 5-1 refer only to the subset of messages between DABS sensors and ATC facilities.

5.3.3 Link Data Field (LDF) Formats

The LDF formats for each ATC-to-DABS and DABS-to-ATC message type are shown in Figure 5-1 and Figure 5-2 respectively. A brief discussion of each data block used in the LDF follows:

5.3.3.1 ATC-to-DABS Data Blocks

5.3.3.1.1 Type Code

The Type Code Block is an 8-bit control block which begins every Link Data Field. The code values are shown explicitly in Figure 5-1, and have been summarized in Table 5-1.

5.3.3.1.2 DABS Address

DABS Address is the unique 24-bit identification code of a DABS-equipped aircraft. The coding is the same as that used in Surveillance Reports (see Section 4.1).

5.3.3.1.3 Message Number (MSG. NO.)

Message Number is a 4-bit binary integer unambiguously numbering all types of Uplink Messages addressed to a particular DABS target. The all-zeros code is excluded so that 15 messages can be distinguished at a time. Note that MSG NO. is not included in message types not addressed to or about a particular aircraft.

5.3.3.1.4 Expiration (EXP)

EXP is a 3-bit block encoding "Time to Expiration" of a message (for Uplink Messages only). It is a binary integer, with the values 1 through 7 representing the number of scans for which delivery should be attempted. The zero code is not used.

5.3.3.1.5 PRIORITY (P)

Priority is a 1-bit block giving a user-supplied priority tag (for certain Uplink Messages only). Immediate delivery of any Uplink Message is attempted regardless of the priority value; only if there is a queue of messages for a particular aircraft is a message tagged Urgent given precedence over one tagged Standard.

1 = Urgent
0 = Standard

		Prefix	Suffix	
ATC-to-DABS	Uplink Messages	0010	0001	Tactical Uplink
		0010	0010	ELM Uplink
		0010	0011	Request for Downlink Data
		0010	0100	ATCRBS ID Request
		0010	0101	Message Cancellation Request
	Status/Control Message	0110	0001	Test
		1001	1011	Altimeter Correction
		1001	1001	ATC Failure/Recovery
		0000	0010	Data Link Capability Request
		0110	0101	Sensor Failure/Recovery Message
		1001	1010	DABS Aircraft Control State Message
		1001	0110	ATCRBS Aircraft Control State Message
	ATARS Operational Messages	1000	(To be defined)	
DABS-to-ATC	Sensor Response Message	0011	0001	Message Rejection/Delay Notice
		0011	0010	Uplink Delivery Notice
	Downlink Messages	0100	0001	Tactical Downlink
		0100	0010	ELM Downlink
		0100	0100	Data Link Capability
		0100	0101	ATCRBS ID Code
		0100	0011	Utility Message
	ATARS Operational Messages	1000	0011	Controller Alert Message
		1000	(Others to be defined)	
	Sensor Performance/ Status Messages	0110	0010	Test Response
		0110	0100	Status Message
		~~1001~~	~~1100~~	~~Track Alert Message~~
	ATARS Recording System Messages	1100	0001	Duplicate ATARS Uplink Message
		1100	0010	Duplicate ATARS Message Delivery Notice
	Relayed Messages	0000	0011	Data Relay Mode

Table 5-1. Link Data Field Type Codes

Tactical Uplink

0 0 1 0 0 0 0 1	DABS Address	Msg No	P	EXP	MA
1 8	9 32	33 36	37	38 40	41 96

ELM Uplink

0 0 1 0 0 0 1 0	DABS Address	Msg No	P	EXP	SP	Length	ELM Text (max 1280)
1 8	9 32	33 36	37	38 40	44	45 48	49 208

Request For Downlink Data

0 0 1 0 0 0 1 1	DABS Address	Msg No	P	EXP	MSRC	SP
1 8	9 32	33 36	37	38 40	41 44	48

ATCRBS ID Request

0 0 1 0 0 1 0 0	DABS Address	Msg No	SP
1 8	9 32	33 36	37 40

Message Cancellation Request

0 0 1 0 0 1 0 1	DABS Address	Msg No	Ref Msg No	Ref Type Code
1 8	9 32	33 36	37 40	41 48

Test Message

0 1 1 0 0 0 0 1	Test Data
1 8	9 56

Altimeter Correction Message

1 0 0 1 1 0 1 1	SP	N	Alt Cor (repeated)
1 8	9 12	13 16	17 24

ATC Failure/Recovery Message

1 0 0 1 1 0 0 1	State	SP
1 8	9 10	16

Data Link Capability Request

0 0 0 0 0 0 1 0	DABS Address	Msg No	SP
1 8	9 32	33 36	37 40

Sensor Failure/Recovery Message

0 1 1 0 0 1 0 1	SID	SP	SSTAT	SP
1 8	12	14	16	24

DABS Aircraft Control State Message

1 0 0 1 1 0 1 0	IP	IS	IU	DABS Address (repeated)
8	11	14	16	16 + 24(IP+IS+IU)

ATCRBS Aircraft Control State Message

1 0 0 1 0 1 1 0	ICA	IUA	ATID (repeated)
1 8	12	16	24*(ICA + IUA)

Fig. 5-1. LDF Formats for ATC-to-DABS Messages

Message Rejection Notice

0 0 1 1 0 0 0 1	DABS Address	Ref Msg No	Qual	SP
1 8	32	36	39	40

Message Delivery Notice

0 0 1 1 0 0 1 0	DABS Address	Ref Msg No	DI	SP
1 8	32	36	37	40

Tactical Downlink

0 1 0 0 0 0 0 1	DABS Address	MB
1 8	32	88

ELM Downlink

0 1 0 0 0 0 1 0	DABS Address	SP	Length	ELM Text (Max 1280)
1 8	32	36	40	120

Data Link Capability

0 1 0 0 0 1 0 0	DABS Address	Capability	SP
1 8	32	93	96

ATCRBS ID Code

0 1 0 0 0 1 0 1	DABS Address	SP	ATCRBS ID
1 8	32	36	48

Utility Message Format

0 1 0 0 0 0 1 1	DABS Address	SP	UM
1 8	32	34	40

Controller Alert Message

1 0 0 0 0 0 1 1	ACID1	ACID2	CS1	Resolution Advisory 1	DEL 1	CS2	*
1 8	32	56	58	69	72	74	

*	Resolution Advisory 2	DEL 2	V1	V2
	85	88	89	90

Test Response Message

0 1 1 0 0 0 1 0	Test Response Data
1 8	56

Fig. 5-2. LDF Formats For DABS-to-ATC Messages

Status Message

01100100	Number of DABS Trks	Number of ATCRBS Trks	Number of Radar Trks	SP	New Code Flag (N)	Code Overflow Flag (V)	Northmark Time
1 8	18	28	38	40	41	42	56

Sensor ID	ATARS Status Flag	Sensor Status	Channel in use (CH)	No. of BCN Strobe Words=2i	No. of Red Codes=k	No. of Yellow Codes=j
60	61	63	64	72	80	88

Boresight AZ of Beginning of Strobe Overload = $B_S(1)$	Boresight AZ of End of Strobe Overload = $B_E(1)$	$B_S(2)$	$B_E(2)$	...	$B_S(i)$	$B_E(i)$
104	120					88+32(i)

Yellow Condition Code Y(1)	Y(2)	...	Y(j)	Red Condition Code R(1)	R(2)	...	R(k)
			88+16(2i+j)				88+16(2i+j+k)

Track Alert Message

1 0 0 1 1 1 0 0	DABS Address	Range 1	SP	Azimuth 1	Range 2	SP	Azimuth 2
1 8	32	48	50	64	80	82	96

Duplicate ATARS Uplink Message

1 1 0 0 0 0 0 1	DABS Address	Msg No	P	EXP	MA
1 8	32	36	37	40	41 96

Duplicate ATARS Message Delivery Notice

1 1 0 0 0 0 1 0	DABS Address	Ref Msg No	DI	SP	Ref Sender ID	SP
1 8	32	36	37	40	44	48

Data Relay Mode Message

0 0 0 0 0 0 1 1	ID of Orig Sensor	DABS to ATC Message
1 8	16	17

Fig. 5-2. LDF Formats For DABS-to-ATC Messages, Cont.

5.3.3.1.6 Not used.

5.3.3.1.7 Comm-A Message Text (MA)

The MA field is a 56-bit block occurring in tactical uplink messages. The coding of this field is dependent on the user and is not constrained by the DABS system.

5.3.3.1.8 Length

Length is a 4-bit block present only in an ELM message. It is a binary integer specifying the number of 80-bit segments comprising the ELM Text block. Its value is one less than the number of segments.The minimum value of Length = 1 (2 segments).

5.3.3.1.9 ELM Text

ELM Text is a variable length ELM data field. Its length is a multiple of 80 bits with a maximum of 1280 bits corresponding to a sequence of 16 consecutive Comm-C ground-to-air transmissions, each carrying an 80 bit MC field of text. The coding of the ELM Text block is dependent on the user and is not constrained by the DABS system.

5.3.3.1.10 MSRC

MSRC is a 4-bit block present only in a Request for Downlink Data. It identifies the particular data being requested. A MSRC code = 0001 signifies a request for an airborne DABS installation extended capability report. Other codes are not assigned at this time. MSRC is the same as the BDS1 field defined in Reference 4.

5.3.3.1.11 Referenced Message Number (REF.MSG.NO.)

Referenced Message Number is a 4-bit binary integer, present only in a Message Cancellation Request (ATC to DABS). It represents the number of the message whose cancellation is being requested. Referenced Message Number is also used in the following DABS to ATC messages: Message Rejection Notice, the Message Delivery Notice, and in the Duplicate ATARS Message Delivery Notice.

5.3.3.1.12 Referenced Type Code (REF.TYPE.CODE)

Referenced Type Code is the 8-bit Type Code block corresponding to a message whose cancellation is being requested.

5.3.3.1.13 Test Data

Test Data is a 48-bit block present only in a Test Message. The contents may be defined by the originator. Each message may be different.

5.3.3.1.14 Not used.

5.3.3.1.15 Index Number (N)

N is a 4-bit binary integer present only in an Altimeter Correction Message. Its value is one less than the number of Altimeter Correction blocks which are present.

5.3.3.1.16 Altimeter Correction (ALT COR)

Altimeter Correction is an 8-bit data block containing the value of a barometric pressure correction for a particular geographic area. The number of such correction blocks in a message (value of N plus 1) is standard for a given ATC facility-DABS sensor pair. The geographic interpretation of each such correction is also a sensor parameter fixed by pre-arrangement with the ATC system. The coding for each block is: Most Significant Bit (MSB) is sign (0=plus, 1=minus), next 3 MSBs represent corrected altitude in feet x 1000 as a binary number (0 to 7000 feet). The four Least Significant Bits (LSB) represent corrected altitude in hundreds of feet as a binary number (0 to 900 feet). The range of the corrected altitude value is -79 to +79 hundred feet.

5.3.3.1.17 State

State is a 2-bit data block occurring only in an ATC Failure/Recovery Message. It is used to inform a DABS sensor of a change in the operational status of an ATC facility.

00	Not Used
01	Failure
10	Recovery from Failure
11	Recovery from Failure with Loss of Data Base

5.3.3.1.18 Primary Index (IP)

Primary Index is a 3-bit binary integer present in a DABS Aircraft Control State Message. Its value is the number of DABS addresses in the message representing controlled aircraft for which the sensor is being assigned primary. If IP is not zero, the corresponding DABS addresses occupy Bit 17 through Bit 16+24*IP of the message.

5.3.3.1.19 Secondary Index (IS)

Seconday Index is a 3-bit binary integer present in a DABS Aircraft Control State Message. Its value is the number of DABS addresses in the message representing controlled aircraft for which the sensor is being assigned secondary. If IS is not zero, the corresponding DABS addresses occupy Bit 17+24*(IP) through Bit 16+24*(IP+IS) of the message.

5.3.3.1.20 Uncontrolled Index (IU)

Uncontrolled Index is a 2-bit binary integer present in a DABS Aircraft Control State Message. Its value is the number of DABS addresses in the message representing uncontrolled aircraft. If IU is not zero, the corresponding DABS addresses occupy Bit 17+24*(IP+IS) through bit 16+24*(IP+IS+IU) of the message.

Note: The maximum length of the DABS Aircraft Control State Message, corresponding to IP=7, IS=7, and IU=3, is 424 bits.

5.3.3.1.21 Spare (SP)

The SP field represents the needed spacing required in some messages in order to minimize shifting in the sensor and shall be set equal to zero.

5.3.3.1.22 DABS Sensor ID (SID)

The Sensor ID field is a 4-bit field which uniquely identifies the DABS sensor whose status is being reported by the ATC facility.

5.3.3.1.23 Sensor Status (SSTAT)

The sensor status as reported by the ATC facility shall be interpreted as follows:

01 = Sensor not failed
10 = Sensor failed
11 = Sensor communications failed

5.3.3.1.24 ATCRBS Track Identifier (ATID)

The ATID field is a 24-bit block in the ATCRBS Aircraft Control State Mesage which contains the ATCRBS code plus the Surveillance File Number of an ATCRBS-equipped aircraft for which the control state (controlled/uncontrolled) is being reported. The first 12 bits of this block contains the ATCRBS mode 3/A code, the second set of 12 bits contains the Surveillance File Number. Coding is the same as that used in ATCRBS surveillance messages.

5.3.3.1.25 Controlled ATCRBS Index (ICA)

The Controlled ATCRBS Index is a 4-bit binary integer present in the ATCRBS Aircraft Control State Message. Its value is the number of ATID's in the message representing controlled ATCRBS aircraft. If ICA is not zero, the corresponding ATID's occupy Bit 17 *through Bit 16 + 24* (ICA) of the message.*

5.3.3.1.26 Uncontrolled ATCRBS Index (IUA)

The Uncontrolled ATCRBS Index is a 4-bit binary integer present in the ATCRBS Aircraft Control State Message. Its value is the number of ATID's in the message representing uncontrolled ATCRBS aircraft. If IUA is not zero, the corresponding ATID's occupy Bit 17 + 24* (ICA) through Bit 16 + 24* (ICA + IUA) of the message. Note: The maximum length of the ATCRBS Control State Message, corresponding to ICA=15 and IUA=15 is 736 bits.

5.3.3.2 <u>DABS-to-ATC Data Blocks</u>

DABS-TO-ATC LDF formats are shown in Figure 5-2. The following blocks have already been defined as ATC-to-DABS blocks: Type Code, DABS Address, Referenced Message Number, Length, ELM Text, MA, Message Number, Exp, P, and SP. Definitions of the remaining blocks follow:

5.3.3.2.1 <u>Qualifier (QUAL)</u>

The Qualifier is a 3-bit bloc! present in a Message Rejection/Delay Notice only.

000 = Target not on file (rejection)
001 = Target not in roll-call mode (delay)
010 = Relayed delivery being attempted (delay)
011 = Sensor not primary (rejection of ELM uplink)
100 = Targets lack ELM capability (rejection)

Other code values not assigned.

5.3.3.2.2 <u>Delivery Indicator (DI)</u>

The Delivery Indicator is a 1-bit bloc present in a Message Delivery Notice only. It reports on the success of a referenced Uplink Message with the following coding:

0 = Message successfully delivered
1 = Message expired, undelivered

5.3.3.2.3 <u>Comm-B Message Text (MB)</u>

The MB field is a 56-bit block used for downlink tactical message text similar to the Uplink MA block.

5.3.3.2.4 <u>Utility Message Text (UM)</u>

UM is a 6-bit text, copied from the UM field of a downlink reply. It contains requested or volunteered data.

5.3.3.2.5 Capability

Capability is a 61-bit block which indicates the input/output capability of the aircraft. It is divided into three subfields defined as follows:

CA (Basic Capability, bits 33-35): This field is the 3-bit CA field contained in DABS All-call replies. Its coding is defined in the DABS National Standard, Paragraph 3.3.6 [4].

ACA (Additional Capability, bits 36-41): This 6-bit field contains data when the CA field so indicates. Specific codes are not assigned at present.

ECA (Extended Capability, bits 42-93): This 52-bit field contains data when the CA field so indicates. Its coding is defined in the DABS National Standard [4]. (Note: The 4 leading bits defined in reference 4 containing BDS1=1, are omitted in ECA).

5.3.3.2.6 ATCRBS ID

ATCRBS ID is a 12-bit block giving the 4096-code value from a DABS transponder. The coding is the standard Mode 3/A format used in Surveillance Reports on ATCRBS targets (see Table 4-1).

5.3.3.2.7 Referenced Sender ID Code (REF.Sender ID)

Referenced Sender ID Code is a 4-bit block occurring in the Duplicate ATARS Message Delivery Notice. It is included specifically to cover the case in which a sensor has delivered an ATARS uplink message originating at a remote ATARS facility, and it enables the ATC facility receiving the duplicate delivery notice to reference the message without ambiguity. Coding is undefined at present.

5.3.3.2.8 Range (1st or 2nd), Azimuth (1st or 2nd)

The range and azimuth fields, respectively 16 and 14 bits long, in the Track Alert Message, are the measured ranges and azimuths of the two targets that are involved in the duplicate address alert situation. Coding is the same as that used in the DABS surveillance message.

5.3.3.2.9 Aircraft Identity (1st and 2nd) (ACID)

The ACID field is a 24-bit block in the Controller Alert Message which contains the DABS address or ATCRBS code plus Surveillance File number of an aircraft in conflict. Coding is the same as that used in surveillance messages. The determination of DABS versus ATCRBS is accomplished using the "CS" field (5.3.3.2.10).

5.3.3.2.10 Control Status (1st and 2nd) (CS)

The Control Status field is a 2-bit block in the Controller Alert Message. It is used to identify the status of each aircraft where the first bit is one for controlled aircraft and zero for uncontrolled aircraft. The second bit is one for DABS aircraft and zero for ATCRBS aircraft.

5.3.3.2.11 Resolution Advisory (1st and 2nd)

The Resolution Advisory field is an 11-bit field in the Controller Alert Message which signifies the Resolution Advisory that is being delivered to the aircraft for execution. It is encoded as follows:

Bit Position in 11-bit field	Resolution Advisory implied when set
1	Turn right
2	Turn left
3	Climb
4	Descend
5	Don't turn right
6	Don't turn left
7	Don't climb
8	Don't descend
Bits 9, 10, 11 of 11-bit field	**Resolution Advisory implied**
000	No vertical speed limit
001	Limit climb to 500 feet per minute (FPM)
010	Limit climb to 1000 FPM
011	Limit climb to 2000 FPM
100	Limit descent to 500 FPM
101	Limit descent to 1000 FPM
110	Limit descent to 2000 FPM

5.3.3.2.12 Not used.

5.3.3.2.13 Delivery Status (1st and 2nd) (DEL)

The DEL field is a 3-bit field in the Controller Alert message which represents the delivery status of the Resolution Advisory contained in the corresponding Resolution Advisory field. It is encoded as follows:

000 = No delivery attempted (for non-ATARS equipped aircraft)
001 = No delivery attempted-controller alert with conflict resolution data
010 = Delivery currently being attempted
011 = Delivered
100 = No delivery attempted - controller alert
101 = Delivered by BCAS
110 = Not used
111 = Not used

5.3.3.2.14 Controller Voice Communications (1st or 2nd) (V)

V is a 1-bit block indicating the possible need for controller voice communictions to the unequipped aircraft involved in an encounter with an ATARS equipped aircraft.

V = 1 implies that the controller should consider giving compatible voice instructions to the controlled-unequipped aircraft to complement the resolution advisory being issued to the equipped aircraft by ATARS.
V = 0 implies that the above conditions do not exist.

5.3.3.2.15 Number of DABS Tracks

Number of DABS tracks in the sensor Track File. This number may be equal to or greater than the number being transmitted to a particular ATC facility.

5.3.3.2.16 Number of ATCRBS Tracks

Number of ATCRBS tracks in the sensor Track File. This number may be equal to or greater than the number being transmitted to a particular ATC facility.

5.3.3.2.16.1 <u>Number of Radar Tracks</u>

Number of Radar only (i.e., search returns which do not correlate with beacon reports or tracks) tracks in the sensor Track File. This number may be equal to or greater than the number being transmitted to a particular ATC facility. Radar tracking is not performed by DABS when interfaced with a Common Digitizer. In this case, the number of radar tracks field will be set to zero.

5.3.3.2.17 <u>New Code Flag (N)</u>

Set when a change (addition or deletion) is made to Beacon Strobe, Yellow or Red code list contained in the previous message.

5.3.3.2.18 <u>Code Overflow Flag (V)</u>

Set when either the number of red or yellow sensor conditions exceed the number that can be reported in this message. Codes are placed in the list in increasing numerical order, thus, when the number of red or yellow codes to be transmitted exceeds "k" or "j" (see 5.3.3.2.25 and 5.3.3.2.26) respectively, the higher number codes are truncated. The codes which have been truncated will not be sent as long as the quantity of lower numbered codes exceeds the maximum.

5.3.3.2.19 <u>Northmark Time</u>

The time that the antenna boresight passed through magnetic north is given via the seconds portion of the sensor real-time clock, with a maximum decimal value of 59.992 seconds and a minimum value of 0 seconds. The northmark time segment has the following binary coded format:

43 45	46 49	50 56
3 Bit BCD representation of seconds x 10	4 Bit BCD representation of secs	7 Bit binary fraction (bit 56 = 1/128 sec)

5.3.3.2.20 <u>Sensor ID</u>

Sensor ID is a 4-bit field. Coding is defined as follows:

Sensor No.	Address
1	0001
2	0010
3	0011
etc.	

5.3.3.2.21 ATARS Status Flag

Set when ATARS fails. This bit setting is derived from the ATARS algorithm. ATARS failures, as detected by the Peformance Monitor, are reported as sensor yellow codes but do not cause the ATARS bit to be set.

5.3.3.2.22 Sensor Status

00 = Green
01 = Yellow
1X = Red

5.3.3.2.23 Channel in Use (CH)

0 = Channel A
1 = Channel B

5.3.3.2.24 Number of Beacon Strobe Words (2i)

Number of strobe sectors = i. Maximum value of i = 10. The maximum number of strobe words (=2i) therefore is 20.

5.3.3.2.25 Number of Red Codes = k

Maximum value of k = 10.

5.3.3.2.26 Number of Yellow Codes = j

Maximum value of j = 25.

5.3.3.2.27 Boresight Azimuth of Beginning of Strobe Overload = $B_S(i)$ and Boresight Azimuth of End of Strobe Overload = $B_E(i)$

$B_S(i)$ and $B_E(i)$ always occur in pairs. In the event that the $B_E(i)$ has not been found at the end of the report, the hex value FFFF is substituted in the corresponding 16 bits reserved for the corresponding B_E report. The completed pair, B_S and B_E will occur as the fist report in the next message. The units of B_S and B_E are Azimuth Units, i.e., Au = 0.022 degree.

5.3.3.2.28 Yellow Condition Code (Y)

Yellow condition codes as detected by the sensor performance monitor are transmitted in ascending numerical order.

5.3.3.2.29 Red Condition Codes (R)

Same comments as above apply to Red Codes.

5.3.3.2.30 Test Response Data

Test Response Data is a 48-bit block present only in a Test Response Message. The data must be an exact duplicate of the Test Data contained in the corresponding Test Message.

5.3.3.3 Data Relay Mode

Any of several types of DABS-to-ATC messages except the Test, Test Response and ATARS Recording Messages can be relayed to ATC via a second DABS sensor. In this case, the Link Data Field format is modified as follows:

(1) The first 8-bit field contains the special Data Relay Mode type code (0000 0011)

(2) The second 8-bit field contains the ID code of the originating (unconnected) sensor.

The full LDF (including Type Code) of the relayed message will be included, beginning in bit position 17, without modification.

For ATC-to-DABS messages, modified formats are not used at the interface, even if relaying is intended.

REFERENCES

(1) International Standards and Recommended Practices, Aeronautical Telecommunications, Annex 10 to the Convention on International Civil Aviation, Volume I, as amended by Amendment No. 61, dated December 1979, International Civil Aviation Organization (ICAO).

(2) ATC Facility Hardware Interfaces for DABS, Report FAA-RD-80-38, April 1980.

(3) DABS Front End Processor/En Route Central Computer Complex Protocol, Report FAA-RD-80-37, April 1980.

(4) DABS National Standard, Order__________.

APPENDIX A

LIST OF ABBREVIATIONS

ARTS	Automated Radar Terminal System
ATARS	Automatic Traffic Advisory & Resolution Service
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radr Beacon System
BCAS	Beacon Collision Avoidance System
CCC	Central Computer Complex
CD	Common Digitizer
CIDIN	Common ICAO Data Interchange Network
DABS	Discrete Address Beacon System
DPS	Data Processing Subsystem
ELM	Extended Length Message
FEP	Front End Processor
ICAO	International Civil Aviation Organization
LDF	Link Data Field
MTD	Moving Target Detector
RDAS	Radar Data Acquisition System (Part of SRAP)
RTQC	Real Time Quality Control
SRAP	Sensor Receiver and Processor